Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supporting Information

Efficient PbS Quantum Dots Solar Cells Employing Conventional Structure

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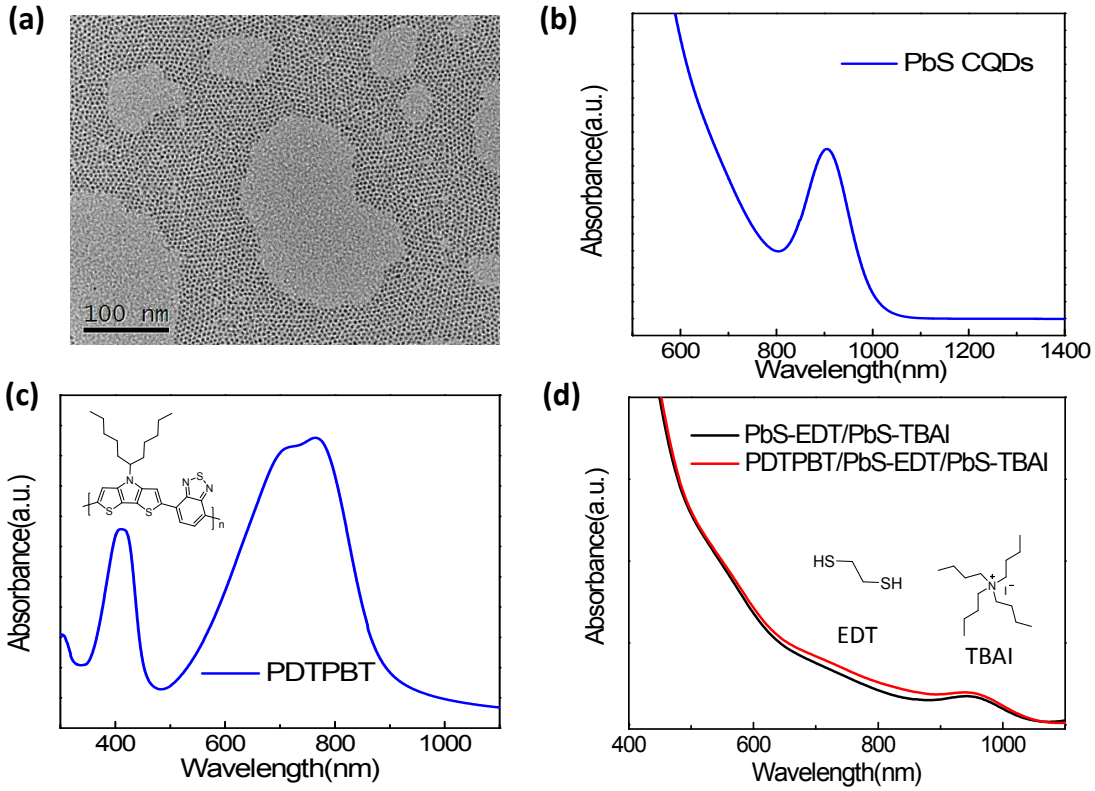

Figure S1. (a) TEM image of the OA capped PbS QDs. (b) Absorbance spectrum of PbS CQD in hexane. (c) Absorbance spectrum of PDTPBT film. The inset shows the molecular structure of the PDTPBT polymer. (d) Absorbance spectra of CQDs films with and without polymer. The inset shows the molecular structures of the ligands.

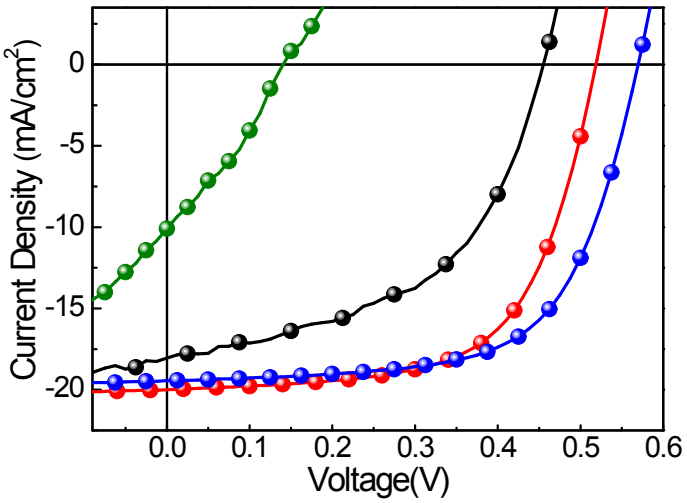

Figure S2. *J-V* curves of CQD photovoltaic devices with different device structures. (Black curve: ITO/PbS-TBAI/Al; red curve: ITO/PbS-EDT/PbS-TBAI/Al; blue curve: ITO/PbS-EDT/PbS-TBAI/LiF/Al; green curve: ITO/PEDOT:PSS/PbS- EDT/PbS-TBAI/LiF/Al)

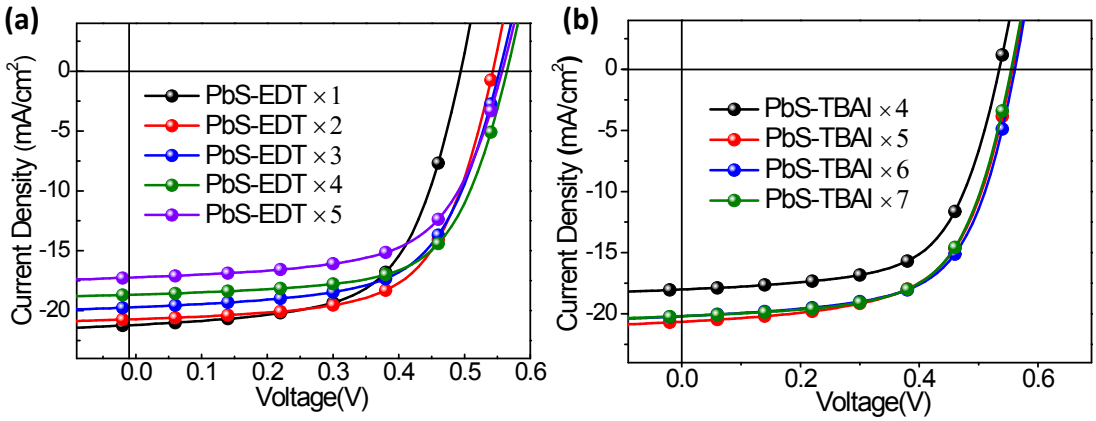

Figure S3. *J-V* curves of CQD photovoltaic devices (ITO/PbS-EDT/PbS-TBAI/LiF/ Al) with different layers of (a) PbS -EDT (PbS-TBAI×5) and (b) PbS-TBAI (PbS-EDT×2).

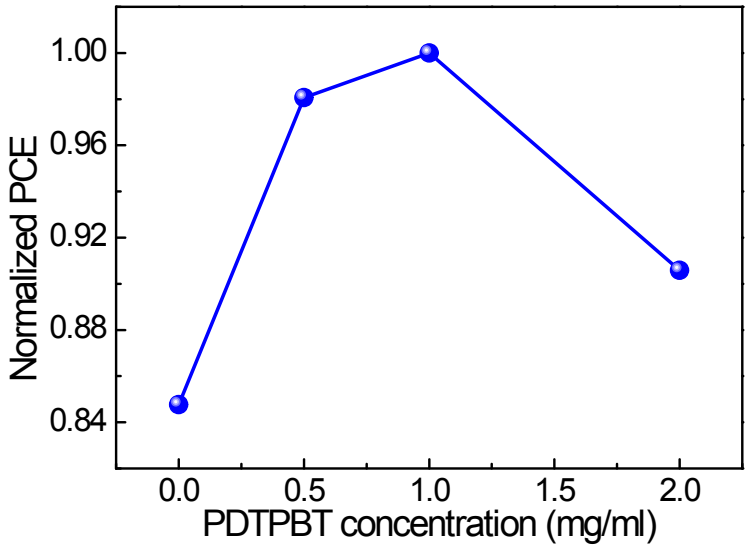

Figure S4. The effect of PDTPBT concentration/thickness on device performance.

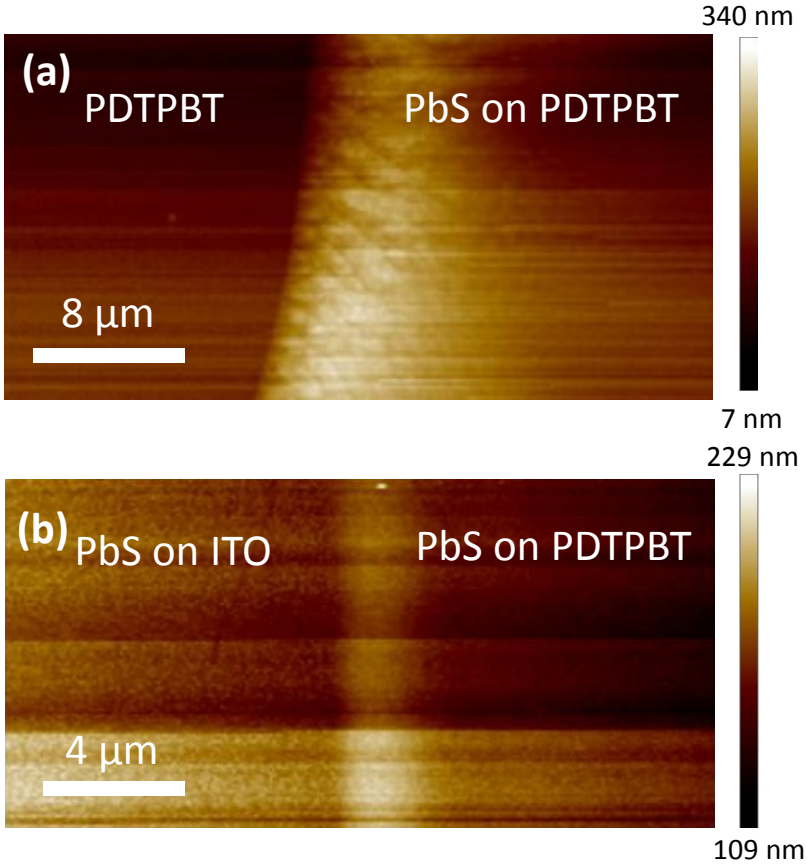

Figure S5. Topographic images of (a) PDTPBT layer partially covered by PbS-EDT film and (b) the PbS-EDT layer on ITO or PDTPBT.

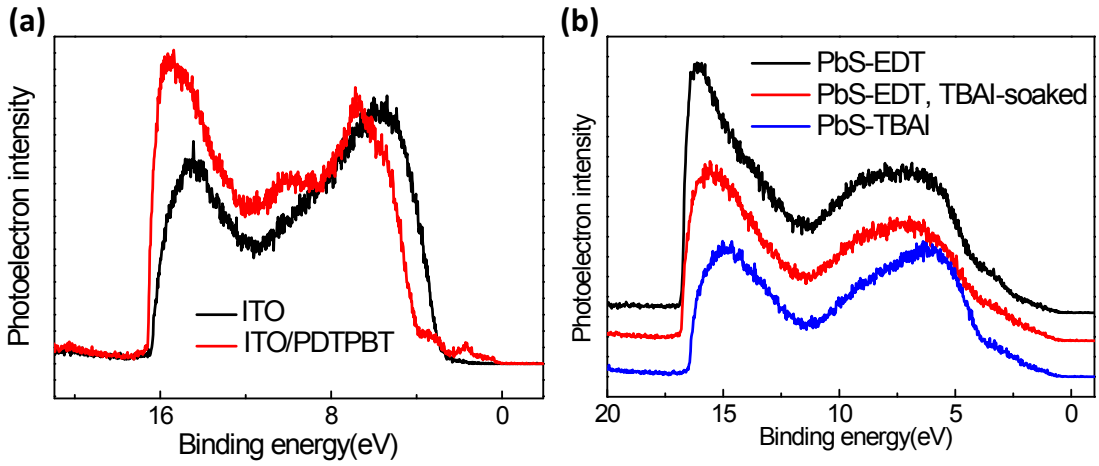

Figure S6. (a) The UPS spectra of ITO and the PDTPBT film. (b) The UPS spectra of a PbS-EDT film, a PbS-EDT film soaked in TBAI solution without depositing a new PbS-TBAI layer, and a PbS-TBAI film. The features from TBAI-soaked PbS-EDT remian constant, suggesting that soaking PbS-EDT film in TBAI solution cannot change it into PbS-TBAI.

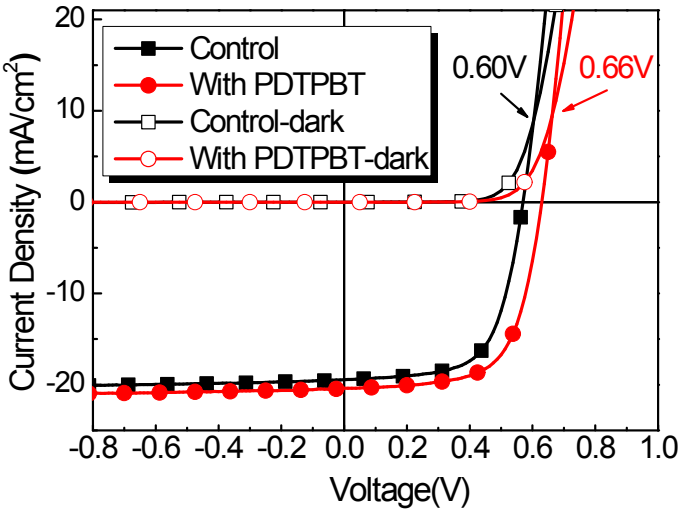

Figure S7. *J–V* characteristics of the devices with and without PDTPBT in the dark and under irradiation.

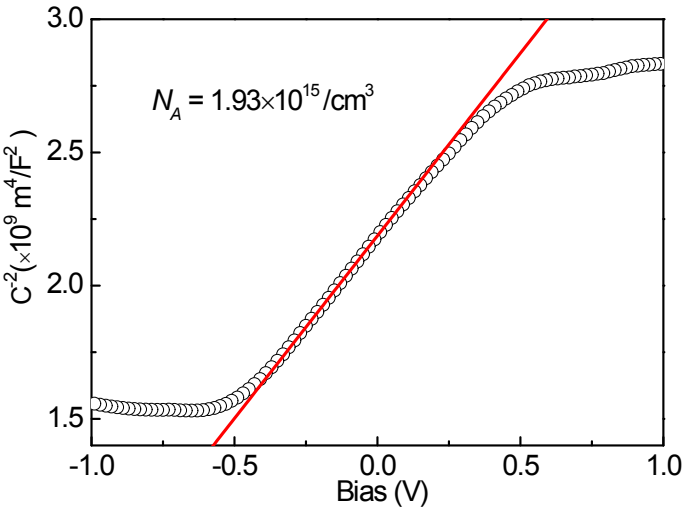

Figure S8. Measured capacitance as a function of bias (C-V) for the sample of ITO/PDTPBT/MoO_3/Ag.

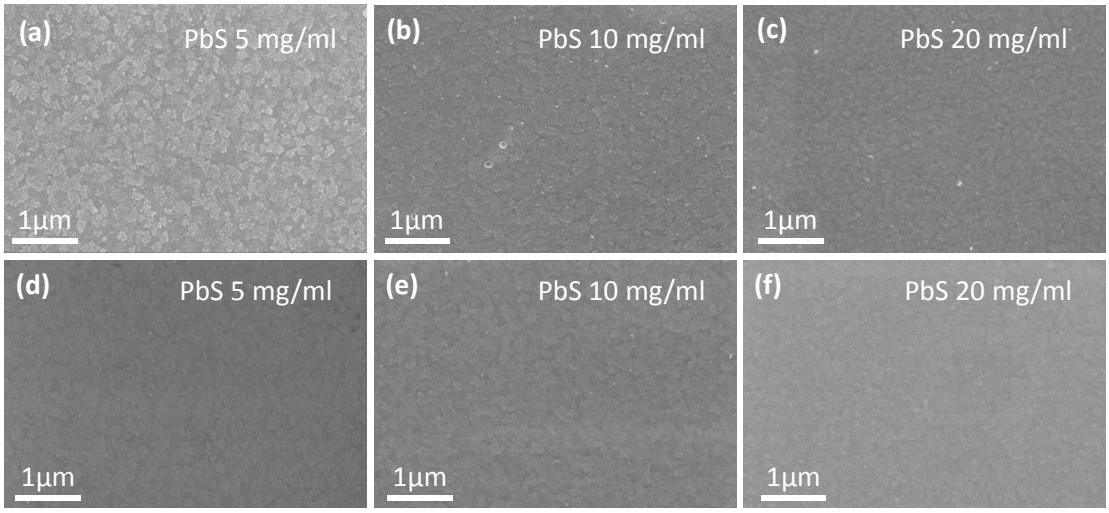

Figure S9. SEM images of the PbS-EDT film deposited on (a)-(c) ITO and (d)-(f) the polymer with different QDs concentration. The PbS QDs films on PDTPBT show more smooth morphology than that on bare ITO.

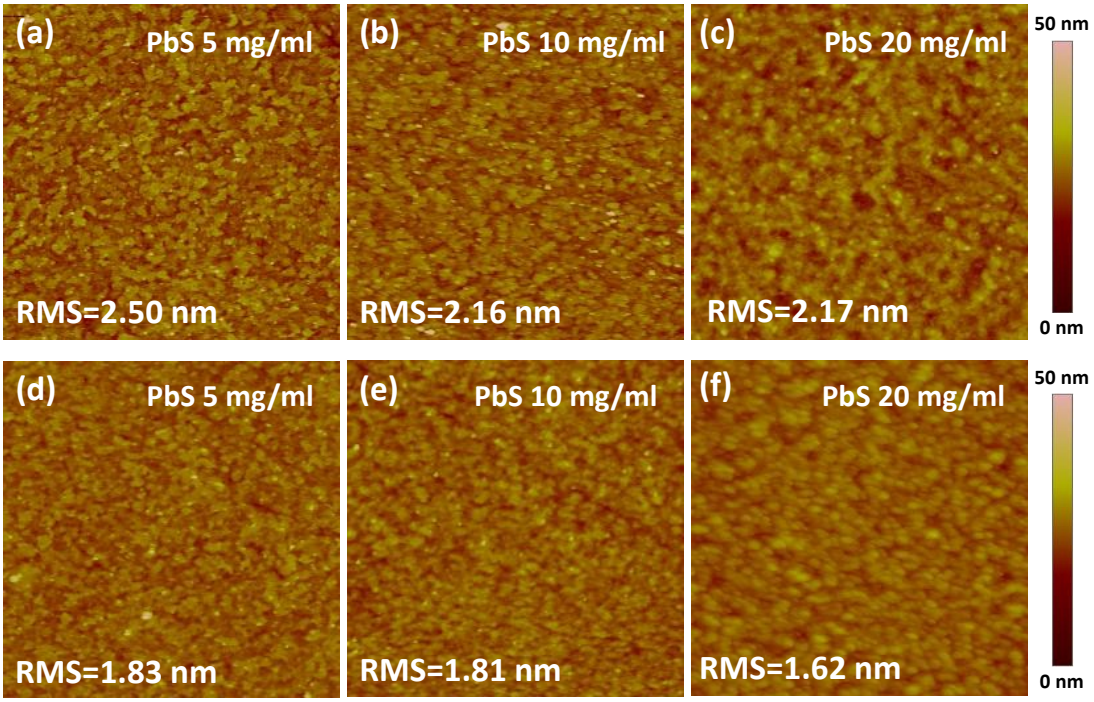

Figure S10. AFM images of the PbS-EDT film deposited on (a)-(c) ITO and (d)-(f) the polymer with different QDs concentration. The PbS QDs film on PDTPBT show lower RMS value than that on bare ITO which is consistent with the SEM measurements in Figure S9.

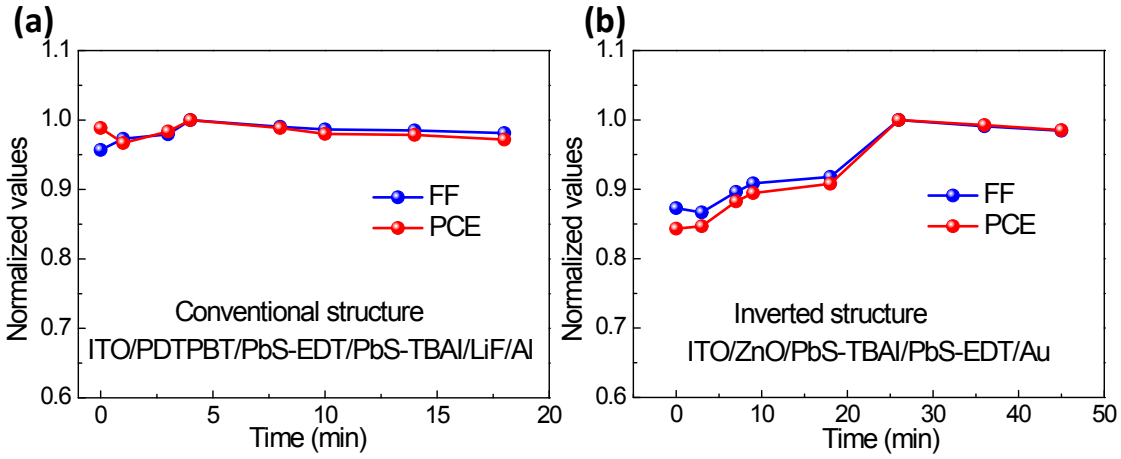

Figure S11. The evolution in PCE and FF as a function of irradiation time for (a) conventional(ITO/PDTPBT/PbS-EDT/PbS-TBAI/LiF/Al) and (b) inverted structure (ITO /ZnO/PbS-TBAI/PbS-EDT/Au).

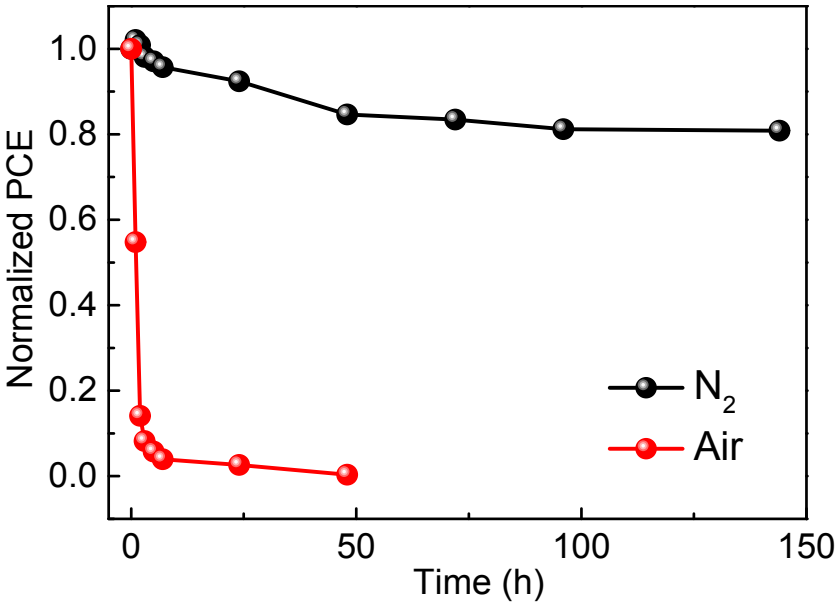

Figure S12. The evolution of PCEs of the unencapsulated devices with conventional structure (ITO/PDTPBT/PbS-EDT/PbS-TBAI/LiF/Al/Ag) under nitrogen and ambient conditions.

Table S1. Device parameters of CQD photovoltaic devices (ITO/PbS-EDT/PbS-TBAI/LiF/Al) with different layers of PbS-EDT and PbS-TBAI.

PbS-EDT	PbS-TBAI	V_{OC} (V)	J_{SC} (mA/cm^2)	FF (%)	PCE (%)
1		0.49	21.18	61.2	6.35
2		0.54	20.71	63.6	7.11
3	5	0.55	19.70	62.4	6.76
4		0.56	18.66	65.1	6.80
5		0.55	17.21	62.9	5.95
2	4	0.53	18.00	63.5	6.06
	5	0.55	20.63	62.2	7.06
	6	0.56	20.19	63.4	7.17
	7	0.55	20.16	63.7	7.06